of *I. mitrata*, a very marked difference presents itself, which shows that the Kina-Balu bird belongs to a new species. Although similar to *I. mitrata* in its general coloration and white-edged quills, it is distinguished at once by its chestnut ear-coverts, while the chin and fore part of the cheeks are also chestnut.

16. Turdus pallens.

Turdus pallens, Pall.; Salvad. tom. cit. p. 256.

An adult specimen sent by Mr. Treacher.

17. Monticola solitarius.

Monticola solitaria (P. L. S. Müll.), Walden, Tr. Z. S. ix. p. 192.

A specimen sent by Mr. Treacher.

This is the second occurrence of the bird in Borneo, the first having been recorded by me under the name of *Monticola pandoo* (Ibis, 1877, p. 13), from Mr. Alfred Everett's Bintulu collection. Mr. Treacher's specimen is in full blue-and-red plumage, with the usual margins to the feathers found in the winter dress.

3. Observations on the Characters of the Echinoidea.—I. On the Species of the Genus *Brissus*, and on the allied forms *Meoma* and *Metalia*. By F. Jeffrey Bell, B.A. Magdalen College, Oxford, Zoological Department, British Museum.

[Received February 18, 1879.]

In an examination of the specimens of *Echinoidea* in the British Museum I have had as my chief aids the 'Catalogue of the Recent Echinoidea in the Collection of the British Museum,' part i., by Dr. J. E. Gray (London 1855), and the 'Revision of the Echini' of Prof. Alexander Agassiz, published at the University Press, Cambridge, U. S., 1872–73. It has been a difficult matter at times to hold a balance between systematists of such widely different principles.

Agassiz recognizes three species of the genus *Brissus*—*B. obesus*, Verrill, *B. carinatus*, and *B. unicolor*. As the Museum collection does not contain any specimen of *B. obesus*, I shall confine what I have to say to the two latter, which are thus distinguished by Agassiz (p. 357):—"The only features by which I am able to separate the two undoubted species of *Brissus* (*B. carinatus* and *B. unicolor*) are the proportions of the anterior and posterior pair of ambulacra, and the striking difference in the course of the fasciole in the anterior part of the test. In *B. carinatus* the posterior ambulacra are much shorter than the anterior pair, while they are nearly equal in *B. unicolor*. There is but one reentering angle in anterior part of fasciole on the anterior interambulacra, while there are two in *B. carinatus*."

Though Dr. Gray distinguishes a larger number of species (just the same, indeed as Agassiz and Desor), he seems to have had a better

acquaintance with his specimens; for he writes:—"The species of this section are most difficult to distinguish; they present several variations, which at first sight appear characters, . . . but these variations do not appear to be permanent in the specimens of the same habitat, but this fact requires verification with a larger series; the form of the fasciole is often different on the two sides of the same specimen" (p. 52).

It is this statement of Dr. Gray's that gives a more accurate account of the real facts of the case, though he might have added, indeed, that the reentering angles vary greatly in depth. Of fifteen specimens which I have examined from the large series in the Museum, four have one reentering angle on either side in the anterior interambulacra; one has no angle on the left, and one on the right side; one has one angle on the left and a shallow one on the right side; four have one angle on the left and two on the right side; and five have two on both sides. With the series in my hands I am therefore unable to come to any conclusion from Agassiz's second distinctive character.

With regard to the other point, the relative lengths of the anterior and posterior ambulacra, I have first to say that in no case that I know of are the anterior longer than the posterior ambulacra; and among such cases I reckon the representation given by Prof. Agassiz (pl. xxi. fig. 1); and, secondly, that of nine specimens selected, that in which the carinate character of the posterior odd interambulacrum was least well marked, had anterior ambulacra measuring 40 millims., and the posterior 43 millims., while in that in which the carination was most marked the anterior ambulacra measured 38 millims., and the posterior 40 millims.

The following Table gives some details as to the just-mentioned nine specimens, which are arranged in an increasing order of carination, as judged by the eye, and are all apparently well-grown specimens, since all are more than 100 millims. in length:—

Table I.

Specimen.	Length of specimen.	Length of ambulacra.		Breadth of anal plastron.	No. of interambulacral angles.	Locality.
		Anterior.	Posterior.			
	millim.	millim.	millim.	millim.	l. r.	
1....	117	40, 40	43, 43	37	1 1	
2....	120	35, 33	36, 34	30	2 2	Naples.
3....	116	34, 34	38, 38	31	1 1	Naples.
4....	116	32, 32	36, 36	29	2 2	Naples.
5....	116	33, 33	35, 36·5	28·5	2 2	
6....	109	39, 39	41, 39	31	1 2	Samoa.
7....	106	32, 32	32, 32	29	1 2	
8....	115	34, 34	36·5, 35	29·5	2 2	Naples.
9....	118	38, 38	40, 40	31	2 2	

In the next Table is given the proportions of five specimens from one locality, Naples; and it will fitly lead to the series of smaller forms.

Table II.

Specimen.	Length.	Length of ambulacra.		Breadth of anal plastron.	No. of inter-ambulacral angles.	Proportion of length of anterior to posterior ambulacra.
		Anterior.	Posterior.			
	millim.	millim.	millim.	millim.	l. r.	
1...	132	42, 41	42, 42	37	2 2	1000 to 1000.
2...	120	35, 33	36, 34	30	2 2	1000 to 1028.
3...	116	34, 34	38, 38	31	1 1	1000 to 1107.
4...	115	34, 34	36·5, 35	29·5	2 2	1000 to 1073.
5...	71	21, 21·5	26, 27	22	1 1	1000 to 1238.

The differences in the length of the ambulacra observed in the last specimen seem to point to this character, so far as it is one, being variable with age.

In the following Table four smaller specimens are compared, and seem to support this supposition :—

Table III.

The first two of these specimens were undoubtedly regarded by Dr. Gray as belonging to the species *carinatus*.

Specimen.	Length.	Length of ambulacra.		Breadth of anal plastron.	No. of inter-ambulacral angles.	Proportion of length of anterior to posterior ambulacra.
		Anterior.	Posterior.			
	millim.	millim.	millim.	millim.	l. r.	
1...	84	27, 27	31, 31	25	1 2	1000 to 1144.
2...	66	20, 20	23, 23	17	1 1	1000 to 1150.
3...	55	17, 16	21, 21	21	1 1	1000 to 1234.
4...	39·5	12, 12	15, 15	14	1 2	1000 to 1250.

From these two tables we may perhaps draw the following conclusions :—(1) In specimens of *Brissus* longer than 100 millims., the proportion of the anterior to posterior ambulacra may be from $\frac{1000}{1000}$ to $\frac{1000}{1107}$. (2) In specimens less than 100 millims. long the same parts may be to one another in the proportions from $\frac{1000}{1144}$ to $\frac{1000}{1250}$[1].

If, then, the characters above detailed are of no value or assistance in the discrimination of the species, we are led to ask what importance is to be attached to the possession of a keeled posterior interambulacrum? its absence in young forms, its variability in older ones, and the littoral habitat of its possessors points rather to its being a character acquired by the individual itself than by the individual from its ancestors. In other words, the variations in carination seem to be such as are compatible with the general characters of the species; it is a ready instance of the difficulty of discriminating between mere varia-

[1] Verrill's measurements of his species *B. obesus* bear out this conclusion; his largest specimen measured 2 inches, the anterior ambulacra ·65, and the posterior ·80, giving thus a proportion of $\frac{1000}{1232}$ (and not, as by some curious slip, Verrill states of $\frac{15}{18}$ [$\frac{1000}{1066}$]).

tion within the limits allowed by inheritance, and the development of useful variations into fixed and definite differences. The only criteria which we can apply to problems of this character seem to be the observation (1) of what obtains in allied forms, and (2) of what obtains in forms living under somewhat similar conditions. The variations which appear to occur in *Metalia sternalis* during growth, and the varieties of *Diadema setosum*, are to be cited as supporting examples of the first, as are the Calcispongiæ of the second of these criteria. The well-marked keel of some specimens of *B. carinatus* seems, then, to be the combined result of variability and of littoral existence; in other words, the species *carinatus* is not a good one, its sole character, the keel, not being a constant attribute of its organization, but a point which has been seized upon by a descriptive naturalist unacquainted from lack of material with both its history and its variations.

It now remains to settle which of the numerous names given to this species should be adopted. In commencing the systematic study of the Echini I hoped to find in the synonymy of Agassiz sufficient evidence of care to enable future workers "to simplify their work by getting rid, to a great extent at least, of the *bête noire* of zoologists, and apply their time to better things." For the British naturalist, unfortunately, Prof. Agassiz's method of nomenclature prevents this desirable result; nor does he, in his reference to pre-Linnæan authors, preserve his consistency: his 'Chronological List,' for example, ascribes the name *Brissus* to Aristotle, but his synonymy to Klein (1734), while *Echinus* falls to the Greek naturalist and to Rondeletius (1554). This difficulty might, however, be pretty easily eliminated; but the omission of synonyms is a more serious matter in a work of such pretensions: thus, in the synonymy of *B. unicolor* we find a reference to *B. ovatus*, Gmelin (1788), but no reference to the preceding species in Gmelin's list, which is *B. unicolor* itself, as is quite distinctly shown by the reference of both Gmelin and Agassiz to pl. xxvi. of Klein's 'Dispositio Echinodermatum.' The date of the specific term *unicolor* being then 1788, what is the date of *carinatus*? Agassiz, in his synonymy, ascribes it to Lamarck, and so places it in 1816; but a second reference to Gmelin shows that he recognized this species, his typographical error of 43 for 48 being corrected by his own reference to p. 249 of Klein's (or rather Leske's) work, where the variety is spoken of as *late-carinatus*. I propose, therefore, to retain the name *unicolor*.

Passing from the question of the identity of the species *B. unicolor* and *B. carinatus*, I come to the consideration of the forms *Meoma* and *Metalia*, which are reckoned as subgenera of *Brissus* by Prof. Alex. Agassiz. Under *Meoma* two species are included, one of which is found on either side the Isthmus of Panama—*M. grandis* and *M. ventricosa*. Whether a larger series than the Museum possesses at present will enable us to show the specific identity of these forms I do not know. The coarser and more distant tuberculation of *M. grandis* affords, as Agassiz has remarked, a ready mark of distinction; and it seems, from a comparison of the arrangement of the

tubercles in different species, to be a character of value. Thus, in *M. grandis* there are large and distant tubercles, not only within the peripetalous fasciole and in the anterior ambulacra, but also over very nearly the whole of the actinal surface. In *M. ventricosa* the large tubercles on the abactinal surface are much rarer, and there are, especially along the ambitus, smaller and more closely packed tubercles; the larger and more distant tubercles are confined more to the anterior end of the actinal surface than they are in *M. grandis*. In *Brissus* the large and distant tubercles are completely absent from the posterior end of the abactinal surface, while on the same surface in *Metalia* the large tubercles are confined within the peripetalous fasciole; and, further, in *Metalia sternalis* they only occupy the margins of the interambulacra.

The example of *M. ventricosa* in the Museum collection is particularly fine. Though obtained in April 1847, it does not figure in Dr. Gray's Catalogue (1855). It was registered under the name of *Amphidetes* (sic) *gigas*, and is reported to have come from Brazil. I found some difficulty in determining it until I lit on the elegant diagnosis given by Prof. Grube of *Brissus panis*[1]. As to the identity of the British-Museum specimen with *B. panis* of Grube I have no doubt; the subjoined details will show some points of resemblance. I add some measurements of *Meoma grandis*:—

	Meoma ventricosa. (B.M.) millim.	*Brissus panis.* (Grube.) millim.	*M. grandis.* (Gray's type.) millim.
Long axis	177·5	162 (=6 German inches)	115
Transverse axis	152	135 (=5 G. i.)	103
Height	82	81 (=3 G. i.)	51
Anterior pair ambulacra	80·80	.. ..	51·53
Posterior ,, ,,	91·88	.. ..	59·60
Length of anal system	21	.. ..	17·5
Breadth ,, ,,	17	.. ..	15

I am not inclined to dispute Lütken's view of the identity of Grube's species with *Meoma ventricosa*, Lamarck. The number of spines preserved on the specimen is fairly good; of those on the abactinal surface I found the greatest length to be about 8 millims.; but I measured one on the actinal surface which reached 12 millims. (Grube's longest spine measured 3 lines). The spines on the ambulacra are somewhat longer and thicker than those on the interambulacra, and are so set horizontally as to bridge over the ambulacral grooves; they are in all cases of a whitish colour, and are not produced into sharp points. The madreporic plate is not less porous than in *M. grandis*. Grube had no information of the locality of his specimen; the most southern locality given by Agassiz is Honduras.

[1] Grube: "Diagnosen einiger neuen Echinodermen," Arch. f. Nat. 1857, pp. 340–344; "Beschreibungen neuer oder weniger bekannten Seesterne und Seeigel," Nova Acta, tom. xxvii. (Jena, 1860).

Before discussing the relation which *Meoma* and *Brissus* hold to one another, it is necessary to refer to the subgenus *Metalia*, under which are included the four species *africana* (Verrill), *maculosa* (Gmelin), *pectoralis* (Lamk.), and *sternalis* (Lamk.).

Of this last-named species there are in the possession of the Museum three examples bearing Dr. Gray's label of *Brissus sternalis*. Two of them are injured, and are apparently the specimens *a* aud *c* of Gray's Catalogue; they are about 160 millims. long, and have the vertex considerably elevated. The third specimen, which is well provided with spines, is not more than 100 millims. long; and no part of the abactinal surface is raised above the general level. Prof. Agassiz (p. 145) credits the Museum with specimens from Raine's Inlet, Port Essington, Reef Attagor, Luzon, and Osmaga (*sic*); all these, with the exception of that from Luzon, are young examples of *Brissus unicolor*. The Luzon example seems, however, to belong to *Metalia*, and may well be the young of *M. sternalis*; were it not for the third of Gray's specimens above mentioned it would be impossible to connect this young form with the large examples. Those in the possession of the Museum incline me to accept Agassiz's account of the changes in this species during growth; but an anxious look-out must be kept for fresh specimens; none have yet been received from the collections made by the 'Challenger' Expedition.

Agassiz distinguishes *Metalia* as a subgenus thus:—"The subgenera *Plagionotus* and *Metalia* are united as a single subgenus of *Brissus* (*Metalia*), the slight difference in the course of the peripetalous fasciole and the presence of larger tubercles not being sufficient ground, with our present knowledge of the changes due to growth, to warrant retaining them both; and as *Plagionotus* is already in use among Coleoptera, the subgenus proposed by Gray has been adopted and amended to include Brissidæ having a more or less broad, elliptical, or undulating re-entering peripetalous fasciole, and an anterior ambulacral groove." I fear I must take exception to this lucid diagnosis; not only is the odd anterior ambulacrum of *M. maculosa* said (p. 599) to be "flush with the test, except towards the ambitus, as it approaches the fasciole, and below it when it is placed in a slight indentation of the test," but a comparison of the "deep" groove of *M. sternalis* with the slight groove of *M. maculosa* and *M. pectoralis* on the one hand, and on the other a comparison of the anterior ambulacrum in *Brissus* and *Meoma*, in which at times there are slight indications of depressions, will be sufficient to show that this character is not of more than specific importance, at any rate. I have, indeed, some hopes of showing that this depression of the anterior ambulacrum is a characteristic of the more lately developed forms; but for the present I must be content to remark that in the Brissine series it is only found in forms which, by the elaborate character of their subanal fasciole, indicate their later appearance.

This subanal fasciole displays the following arrangements:—In *Meoma* it is a narrow band, which does not extend beyond the ac-

tinal boundary of the ambitus, and is never closed; in *M. grandis* it forms a slightly convex line, which bounds the posterior end of the actinal plastron, and then turns upwards at a very open angle; in *M. ventricosa* the horizontal line is straighter, the lateral bands longer and almost perpendicular to the former. In *Brissus* the same fasciole is a little broader, amd is always closed, the resulting figure being cordiform, often more or less truncated at its base. In *Metalia* the fasciole around the subanal plastron is still broader; and there is, in addition, a narrower band on either side of the anus, which extends just beyond the ambitus, and is of the form of the fasciole in *Meoma ventricosa*: the result is, that we have the effect of the presence of the fascioles of both *Meoma* and *Brissus* in *Metalia*. Whatever value these characters have from a genetic point of view, there can be no doubt as to their ready accessibility and general constancy.

To resume. *Meoma* displays the simplest form of subanal fasciole, and the most general distribution of the primary tubercles; the anterior ambulacrum is but slightly depressed; and the anterior lateral ambulacra are to the posterior ones in the proportion of from $\frac{1000}{1081}$ to $\frac{1000}{1135}$.

In *Brissus* the subanal fasciole is closed, and the larger tubercles are absent from the posterior portion of the abactinal surface; it is rarely that the anterior ambulacrum is depressed beyond the level of the test; and the lateral ambulacra stand to one another in the proportion of from $\frac{1000}{1000}$ to $\frac{1000}{1250}$ (in adult specimens the ratio barely exceeds $\frac{1000}{1100}$). The subanal plastron is provided with three or four pores on either side, but there are no radiating bands.

It is in *Metalia* only that the anterior ambulacrum is ever found in a deep and well-marked groove; the larger tubercles are confined within the peripetalous fasciole; the subanal fasciole gives off bands to either side of the anus; and the lateral ambulacra are to one another in ratios varying from $\frac{1000}{1250}$ to $\frac{1000}{1440}$. The subanal plastron may have as many as nine pores on either side; and well-marked radiating lines extend outwards to them from the more median region of the plastron.

[1] Species.	Length of ant. amb.	Length of post. amb.	Proportion.
Meoma grandis (i.)	49, 49	53, 53	1000 to 1081
,, ,, (ii.)	52, 52	59, 59	1000 to 1134
Metalia sternalis (i.).....	72, 72	90, 90	1000 to 1252
,, ,, (ii.)	69, 69	87, 87	1000 to 1260
M. pectoralis (i.)	65, 65	90, 90	1000 to 1384
,, ,, (ii.)	68, 68	98, 98	1000 to 1441